CROSS COUNTRY SOARING

by W. S. IVANS, JR.

Cross-country soaring flights customarily begin with the launching of the sailplane at altitudes ranging from several hundred to several thousand feet above the ground. From a height of 2000 feet, a high performance sailplane can glide in still air perhaps 10 miles before being forced to land. Greater distances than this can be traversed only if the pilot can locate and use updraft areas, in which rising air currents provide a source of energy which can be used to offset the aerodynamic losses due to motion of the sailplane through the surrounding air. If the updrafts are strong enough to exceed the sinking speed of the sailplane, altitude will be gained, corresponding to a storage of potential energy. This stored energy may be called upon to supply losses during subsequent periods of flight in still air or downdraft areas.

It follows that cross-country sailplane navigation is essentially a three-dimensional problem. The pilot must necessarily perform the usual functions of determining his present position and the relative position of his intended goal. He must, in addition, constantly face the problem of maintaining a safe altitude above the earth. The fact that his sailplane has an irreducible minimum sinking speed contributes toward making cross-country soaring an interesting and sometimes exciting endeavor.

A. Meterological and Orographic Conditions Favorable to Cross-Country Soaring.

Three major categories of updrafts may be established, those due to:

1. Convective Instability,
2. Interaction of Horizontally Moving Air Masses, and
3. Displacement of Horizontally Moving Air Masses by Terrain.

Most long distance flights in the United States, including the record flight of 535 miles, have been made during thermal soaring conditions.

This type of soaring may involve updrafts of great intensity. It also involves flying in very turbulent air, with danger from freezing rain and hail

Ridge Soaring is pleasant and easy: considerable distance may be traversed along extending ridges, such as characterize the Allegheny Mountains in eastern U.S. Wave Soaring requires special equipment and preparations. Extreme turbulence may be encountered in the neighborhood of the updraft zone. Oxygen equipment is required, and provisions must be made for protection of the pilot from subzero temperatures. Only recently exploited for soaring, the Standing Wave offers great possibilities for record-breaking cross-country flights, possible in excess of 1000 miles.

B. Sailplane Characteristics Favorable to Cross-Country Soaring.

In order to be effective under the widest possible variety of soaring conditions, a sailplane should:

1. Have a low minimum sinking speed, and
2. Have a relatively flat glide at high speeds.

A low minimum sinking speed is required in order to permit utilization of weak thermal or other updrafts. A flat glide at high speed permits rapid progress to be made when updrafts are strong, and makes it possible to traverse downdraft areas with minimum loss of altitude.

The pilot must take advantage of the performance capabilities of his craft by flying at air speeds best suited to particular soaring situations. On a day when thermal updrafts are strong, the optimum speed between thermals is usually greatly in excess of the speed which produces maximum glide ratio, since altitude loss is easily and quickly recovered in the next thermal. If, on the other hand, soaring conditions are poor, or if he finds himself at a dangerously low altitude, he must fly at the "maximum glide" speed, in order to traverse as great a distance as possible, hoping to find an updraft, before he is forced to land.

Since sailplanes often are flown into extremely turbulent air in search of updrafts, they must perforce be rugged in construction. A typical cross-country sailplane such as the Schweizer 1-23 has an ultimate load factor of 13 g, exceeding load factor specifications for all but military type powered aircraft.

C. Restrictions upon Routes and Choice of Goal.

If a soaring flight is to be made solely through use of ridge updrafts, the choice of route is obviously limited, and the goal must lie within gliding distance of the ridge. A somewhat similiar restriction applies to wave soaring; here, however, the goal may lie hundreds of miles from the point of departure from the wave, owing to the very great altitudes attained. Soaring ahead of a cold front is much like ridge soaring; in this case, to be sure, the "ridge" is in motion, but, except for the final glide to goal, flight is confined to the region of the frontal boundary. Thermal soaring imposes the least restriction on choice of route and goal, conditions which favor thermal development are often found over relatively enormous areas.

C. Restrictions upon Routes and Choice of Goal.

The influence of wind is a prime consideration in determining whether or not it is possible to reach a particular goal, entirely aside from the effect of wind as a generator of updrafts. For example, the high winds aloft which characterize wave soaring can be used to double or treble the glide angle of a sailplane with respect to the earth's surface, if a goal is chosen downwind of the mountain chain which initiates the standing wave. Conversely, progress toward a goal which is to windward of the wave soaring area is greatly impeded by the headwind.

In order to be able intelligently to establish a goal, a considerable amount of planning and gathering of information is required. Maps will show the location of ridges, and mountain ranges where ridge or wave soaring are likely to be found. The orientation of these terrain features must be correlated with information as to wind direction and velocity. A knowledge of atmospheric lapse rates is essential in the prediction of thermal updraft formation and intensity. Temperature

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